

The Usefulness of Nuclear Magnetic Resonance (NMR) Spectrometry in Environmental Applications

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Nuclear magnetic resonance (NMR) spectroscopy is a powerful analytical technique that can be used to determine chemical structures and provide information on the amount of a given chemical present in environmental samples. Like its close cousin, the magnetic resonance imaging (MRI) scanner found in hospitals, NMR relies upon the use of a powerful magnet. When a sample is placed in this powerful magnet and irradiated with a radio frequency, the atoms in the sample absorb energy and produce a signal. The signal is processed by a data system to yield a spectrum that is unique, like a fingerprint, and can be used to identify constituents present in a sample. Each signal in the resulting NMR spectrum is proportional to the concentration of the atoms in a sample and, as such, can be used to determine the amount of each constituent present in a sample. NEIC has used NMR as an analytical technique in environmental enforcement cases to provide complimentary data to supplement traditional analytical techniques used for environmental samples and, at times, NMR has been a key technique for resolving analytical issues in environmental enforcement cases. Three recent uses of NEIC's NMR spectrometer for environmental enforcement cases will be presented, including (1) the identification of alcohols and glycols in environmental and process samples from an antifreeze recycling facility, (2) the identification and measurement of low levels (<2%) of impurities in formulations of the pesticide, and (3) the identification and measurement of a cobalt complex in waste samples from an automobile air bag inflator manufacturing facility.